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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/620,426	07/17/2003	Sujit Sharan	MI22-2360	5111
21567	7590	07/12/2007		
WELLS ST. JOHN P.S. 601 W. FIRST AVENUE, SUITE 1300 SPOKANE, WA 99201			EXAMINER DANG, TRUNG Q	
			ART UNIT	PAPER NUMBER
			2823	
			MAIL DATE	DELIVERY MODE
			07/12/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.		Applicant(s)	
	10/620,426		SHARAN ET AL.	
	Examiner		Art Unit	
	Trung Dang		2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 June 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8, 11-20 and 22-38 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8, 11-20, 22-38 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 June 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>7/17/03</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-6, 8, 11-14, 23-25, and 37 are rejected under 35 U.S.C. 102(b) as being anticipated by Okumura et al. (US 5,916,820).

With reference to Figs. 3B-3D and the text in col. 6, lines 37-67, the prior art teaches a plasma enhanced chemical vapor deposition (PECVD) method for filling a gap with silicon oxide comprising the steps of:

- a) placing a substrate within a PECVD reactor;
- b) depositing silicon oxide layer 15 (Fig. 3B) under a first deposition condition of:
 - a TEOS flow rate of 80 sccm and an oxygen flow rate of 200 sccm,
 - a powers of 360 W and 120 W applied to the upper and lower electrodes;
- c) continuing the deposition by simultaneously depositing and etching to form silicon oxide layer 16 (Fig. 3C) under a second deposition condition of:
 - a TEOS flow rate of 20 sccm, an oxygen flow rate of 50 sccm, and an argon flow rate of 50 sccm,
 - a powers of 1000 W and 200 W applied to the upper and lower electrodes;

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d) continuing the deposition to form silicon oxide layer 17 (Fig. 3D) under the same deposition condition as in step b).

Note that, col. 5, lines 46-47 discloses that oxygen contributes to the shaping (shoulder removal) of the oxide film. That is, the presence of oxygen in plasma environment contributes an etching component. This is further evidenced by the U.S. Pat. 5,872,958 which is cited merely for showing the fact (see col. 4, lines 19-22). Therefore, even though the deposition of step (b) is absent of argon as primary etching gas, an etching component inherently exists to some degree due to the presence of ionized oxygen gas. Thus, the deposition of step (b) has two components: deposition component and etch component, wherein the deposition to etch ratio (hereinafter D/E ratio) is higher than D/E ratio of step (c) because the process of step (b) is substantially depositing as compared to the process of step (c) which is simultaneously depositing and etching due to the presence of the primary etch gas argon.

The reference, therefore, anticipates the claimed invention in that it discloses a PECVD method comprising:

placing a substrate within a plasma enhanced chemical vapor deposition reactor;
providing a plurality of reactant gases within the reactor proximate the substrate under high density plasma conditions effective to form a layer on the substrate; the conditions resulting in etching of portions of the layer during its formation and thereby including a deposition to etch ratio of the forming layer;

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changing the conditions during the forming to change the deposition to etch ratio; and

wherein the changing of the conditions comprises:

starting with a high deposition rate relative to an etch rate (high D/E ratio in step (b) above);

reduces the deposition to etch ratio at least once during formation (low D/E ratio in step (c) above);

and subsequently increases the deposition to etch ratio during formation (high D/E ratio in step (d) above).

As for the claimed limitation "high density plasma", since the term "high" is a relative term to the extent of being compared with reference value, the density plasma of the reference is considered "high" with respect to a non-plasma environment.

For claims 2, 3, 4, 6, 14, 23 see the reactant gas flow rates and the power settings of steps (b) and (c) above.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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4. Claims 16-20, 22, 27-36, and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura et al as above in view of Van Cleemput et al. (US 5,872,058).

Okumura teaches a PECVD method as described above.

The primary reference differs from the claims in that Okumura's process is to fill gaps between metal wiring using TEOS (TetraEthylOrthoSilicate) as a precursor for silicon as opposed to the claimed filling shallow trench isolation (STI) using silane as a precursor for silicon.

Van Cleemput teaches a PECVD process in which STI or gaps between conductive lines are filled with silicon oxide using silane as precursor (col. 1, lines 13-15; col. 3, lines 10-30).

Thus, modifying Okumura's process to fill STI using silane gas as suggested by Van Cleemput would have been reasonably expected by one of ordinary skill in the art because silane and the PECVD process of using it to fill STI or gaps between wiring lines has been widely recognized in the art, and the application of a known material to make the same would have been within the level of one skilled in the art.

5. Claims 7, 15, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura et al as above in view of Fazio et al. (US 6,573,152).

Okumura teaches a PECVD method as described above.

The primary reference differs from the claims in that while the changes of D/E

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ratios from step (b) to (c) and from step (c) to (d) are effectuated by changing both the flow rates of reactant gases and the power setting, the claims call for changing D/E ratio by changing a flow rate of at least one reactant gas while maintaining constant power setting.

Fazio teaches a PECVD process for filling STI with silicon oxide in which D/E ratio can be changed by keeping the power setting constant while changing the flow rates of reaction gases (col. 4, lines 6-18).


It would have been obvious to one of ordinary skill in the art to modify Okumura's teaching by changing the D/E ratios from step (b) to step (c) and from step (c) to step (d) by keeping the power setting constant while changing the flow rates of reaction gases as suggested by Fazio because such is recognized to alter the D/E ratio, and the application of an art recognized alternative to achieve the same would have been reasonably expected by one skilled in the art.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Trung Dang whose telephone number is 571-272-1857. The examiner can normally be reached on Mon-Friday 9:30am-6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


Trung Dang
Primary Examiner
Art Unit 2823

7/7/07